

CTE Standards Unpacking
Middle School Introduction to STEM

Course: Middle School Introduction to STEM

Course Description: This course serves as an introduction to Science, Technology, Engineering and Mathematics (STEM) with primary areas of focus on aviation, energy, engineering, and robotics. It will provide a basic background to allow students to identify interests which may assist students in pathway and course selection at the secondary level.

Career Cluster: STEM

Prerequisites: None

Program of Study Application: This is a STEM Cluster Course in the STEM Engineering Pathway. It is recommended that the course be preceded by a series of foundation courses followed by additional cluster courses and more specialized pathway courses at the secondary level. These pathways may include courses related to Robotics, Energy, Engineering and Aviation.

| INDICATOR #STEM 1: Understand the components of STEM | | |
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| SUB-INDICATOR 1.1 (Webb Level: 2): Understand the components of STEM and the impact of STEM on society | | |
| SUB-INDICATOR 1.2 (Webb Level: 3): Explore the impact of STEM related careers | | |
| <p>Knowledge (Factual) STEM stands for Science, Technology, Engineering and Mathematics</p> <p>There are multiple careers opportunities that apply STEM skills and knowledge.</p> <p>The applications of STEM fields have resulted in multiple changes to society.</p> | <p>Understand (Conceptual): STEM is an important aspect in daily life</p> <p>STEM careers have a significant impact globally, with cultural, social, environmental economic and political ramifications.</p> <p>STEM appears in many aspects of our daily lives and continues to be an integral part of our society.</p> <p>STEM is involved in careers Globally, requiring dynamic skills and the ability to solve problems and to think critically.</p> | <p>Skills (Application): Investigate and explore the components of STEM and its global impact.</p> <p>Analyze how STEM has impacted the student's life.</p> <p>Research and create a presentation related to a STEM based career of interest.</p> |

Benchmarks

Students will be assessed on their *ability* to:

- Investigate and explore the components of STEM and its global impact.
- Analyze how STEM has impacted the student's life.
- Research and create a presentation related to a STEM based career of interest.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):

Science/Engineering Practices
Asking Questions
Analyzing and Interpreting Data
Argumentation from Evidence
K-12.H.4 Students will identify and evaluate the causes and effects of past, current and potential events, issues and problems.
K-12.E.3 Students will analyze the ways government can impact the market.

CCSS.ELA-LITERACY.RL.6.1
Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

Sample Performance Task Aligned to the Academic Standard(s):

Assess the impact of significant inventors, technology and industrialization on mid-1800s America

Describe the impact of technology and industrialization on mid-1800s America

INDICATOR #STEM 2: Understand the foundation of STEM in aviation.

SUB-INDICATOR 2.1 (Webb Level: 4): Identify how STEM is applied in the field of aviation.

SUB-INDICATOR 2.2 (Webb Level: 3): Evaluate careers related to aviation

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| Knowledge (Factual): Learn how to evaluate Aviation concepts | Understand (Conceptual): STEM applications simulate how an object flies. | Skills (Application): Ability to operate small drones and flying objects. |
| Benchmarks Students will be assessed on their <i>ability</i> to: <ul style="list-style-type: none"> Fly a drone and/or unmanned space vehicle and perform an experiment related to flight aviation. | | |
| Academic Connections | | |
| ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): 8.H.5.2 Generate questions to analyze why individuals or groups, and their developments, are seen as historically significant. 6-8-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. | Sample Performance Task Aligned to the Academic Standard(s): Write a sample instructional technology papers. Research when and when not to use cameras installed drones. What are the implications and consequences of unethical and illegal activities. | |

INDICATOR #STEM 3: Understand the foundation of STEM in relation to Energy

SUB-INDICATOR 3.1 (Webb Level: 4): Identify the application of STEM in the field of energy and/or energy production.

| <i>SUB-INDICATOR 3.2 (Webb Level: 3):</i> Explore the career opportunities in the field of energy related to STEM | | |
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| <p>Knowledge (Factual): Energy sources and their applications</p> <p>Renewable and nonrenewable energy sources New and renewable energy sources eg, ethanol, wind, and solar</p> <p>Career options related to energy and the sources of energy</p> | <p>Understand (Conceptual): STEM is applicable in careers.</p> <p>Apply energy sources to world wide consumption. Trade offs between various energy sources.</p> | <p>Skills (Application): Compare and contrast renewable and nonrenewable energy Generate wind energy by creating a turbine using given materials.</p> <p>Fermentation of corn starch or lignocellulosic carbohydrates into bioethanol</p> <p>Evaluate different career opportunities in STEM with focus in alternative energy</p> |

Benchmarks

Students will be assessed on their *ability* to:

- Create a solar cooker to cook an egg.
- List different types of energy and energy sources.
- List the type of career options related to energy.
- Analyze new/alternative energy sources and the positive and negative aspects of each

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):

MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's systems. (SEP: 7; DCI:

MS-ESS3.C; CCC: Cause/Effect, Technology, Nature Science/Consequence-Actions). Summarize different alternative energy sources and their uses.

Sample Performance Task Aligned to the Academic Standard(s):

Research the use of energy by the human population in a rural area and in a more densely populated area. Compare and contrast the energy needs of humans in densely populated areas and sparsely populated areas. Research forms of alternative energy and evaluate their impact on the earth.

Analyze forms of alternative energy sources and create a data table/graph.

INDICATOR #STEM 4: Understand the foundation of STEM in Engineering.

SUB-INDICATOR 4.1 (Webb Level: 4): Understand how STEM is a part of all aspects of engineering

SUB-INDICATOR 4.2 (Webb Level: 3): Evaluate the career opportunities associated with engineering

Knowledge (Factual):

Different fields of engineering and the different types of engineers

Connection of science, technology, engineering

Understand (Conceptual):

STEMS is found in different forms and types of engineering.

Careers will entail STEM in all areas.

Skills (Application):

Create a prototype of a design idea. After testing prototype, follow the revision process to improve the design.

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| and mathematics to all fields of engineering Career fields in engineering and related occupations | | When given a problem, create a design plan, create a course of action and communicate intentions with other. When given a product, research the type of engineering necessary for the product to have been created. |
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Benchmarks

Students will be assessed on their *ability* to:

- Name the different fields of engineering
- Identify how STEM is applied to different engineering fields Identify the types of engineers
- Evaluate the career opportunities related to different fields of engineering

Academic Connections

| ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): | Sample Performance Task Aligned to the Academic Standard(s): |
|---|---|
| 6-8-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. | Students will create various engineering models using LEGOS. Engineering camps which host competitions will be held. |

INDICATOR #STEM 5: Understand the foundation of STEM in robotics.

SUB-INDICATOR 5.1 (Webb Level: 4): Explore the relationship between STEM and robotics

SUB-INDICATOR 5.2 (Webb Level: 3): Evaluate the career opportunities associated with the field of robotics.

| Knowledge (Factual): | Understand (Conceptual): | Skills (Application): |
|--|---|--|
| Learn the basic concepts and building blocks of a robot such as design, engineering, and software components.. | <p>Understand how a robot works.</p> <p>Identify human careers replaced by robotics.</p> <p>Research and report on a specific career of interest in the robotics field.</p> <p>Write a biography about a historic person in the field of robotics</p> | <p>Build a simple robot using available components.</p> <p>When given a product, research the type of engineering and STEM fields, necessary for the product to have been created.</p> <p>Compare and contrast career opportunities related to different fields of robotics.</p> |

Benchmarks

Students will be assessed on their *ability* to:

- Describe how the robotics field may influence the job market. Identify the uses of robots
- Demonstrate understanding of basic components of a robot
- Design and/or program a robot to follow a set of commands.

Academic Connections

| ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): | Sample Performance Task Aligned to the Academic Standard(s): |
|---|--|
| <p>RBT 5.1 Explore career opportunities in the robotics field Examples: Robotic surgeries, Police and fire and rescue robotics. The uses of robotics in business and industry. Learn about ethical and social impact of using robots.</p> <p>6-8-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the</p> | <p>Research available resources to find how robots may be useful in helping disabled people.</p> |



Additional Resources

Please list any resources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.

<http://www.auvsi.org/content/conduct>

<http://www.acm.com>

<http://www.ieee.org>

[https://www.wpi.edu/Pubs/E-project/Available/E-project-030410-172744/unrestricted/A Code of Ethics for Robotics Engineers.pdf](https://www.wpi.edu/Pubs/E-project/Available/E-project-030410-172744/unrestricted/A%20Code%20of%20Ethics%20for%20Robotics%20Engineers.pdf)

<http://robots.law.miami.edu/2014/wp-content/uploads/2014/03/a-code-of-ethics-for-the-human-robot-interaction-profession-riek-howard.pdf>

<http://ethics.iit.edu/ecodes/node/4391>

<http://www.sans.org/security-resources/ethics.php>

<http://www.bestinc.org/>

<http://www.usfirst.org/roboticsprograms/ftc>

<http://www.vexrobotics.com>

STEM Robotics 101: <http://stemrobotics.cs.pdx.edu/node/190?root=291>

Career Research: www.sdmylife.com and <http://www.onetonline.org>